An Acoustic and articulatory study of the three-way laryngeal contrast in coronal stops of Balti

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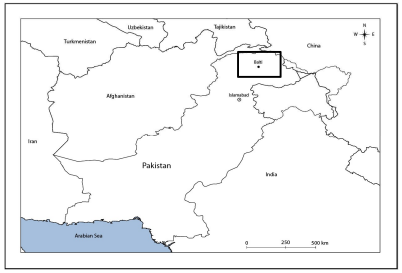
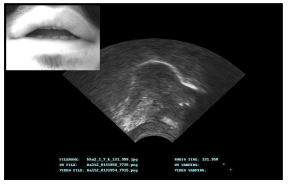
Background

- Balti is an endangered Tibeto-Burman language spoken in Gilgit-Baltistan, Northern Pakistan (DeLancey, 2003).
- Around 327,000 speakers (Lewis et al., 2016).
- Along with Ladakhi and Purik, Balti belongs to the Western Archaic branch of the Tibetan family (DeLancey, 2003; Lobsang, 1995).
- It is considered one of the most archaic dialects of Tibetan. However, compared to other Tibetan languages, Balti is still an understudied language, particularly from a phonetic/phonological perspective.
- Except for a handful of acoustic studies (Caplow, 2016), no other data are available.

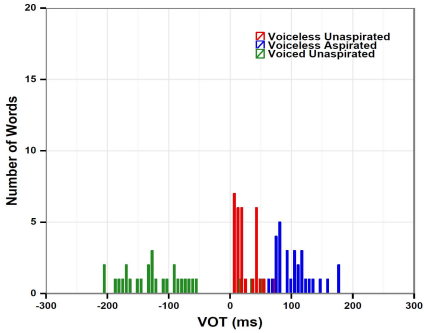


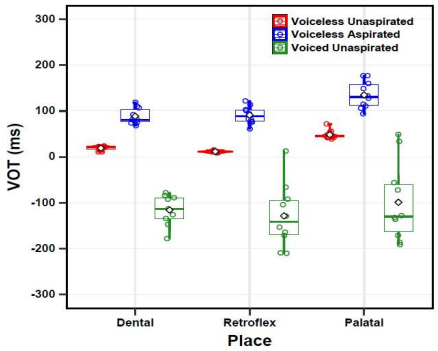
- Balti is characterized by a three-way laryngeal contrast (voiceless unaspirated, voiceless aspirated, and voiced unaspirated) at three coronal places of articulation (dental, retroflex, and palatal).
- Aim: present a preliminary acoustic and articulatory analysis of the coronal stops of Balti.

Methods



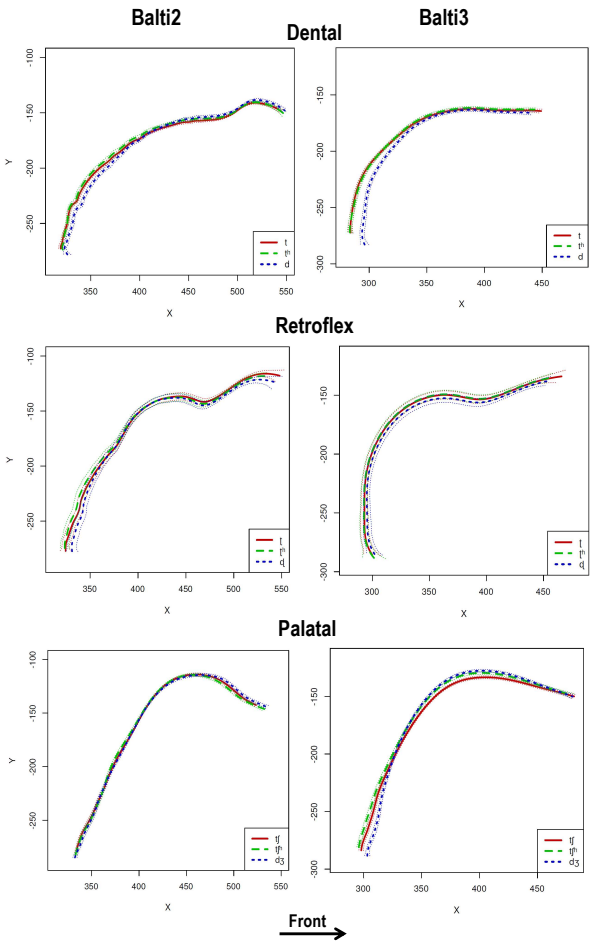
- Two speakers of Balti (Balti2 and Balti3).
- Recruited from Gilgit-Baltistan.
- Stop consonants followed by /a/ (/ta/, /ʈa/ etc.).
- Reading task (words elicited in isolation).
- Simultaneous audio (44100 Hz), ultrasound (60 fps), and video (30 fps) recording.
- Shure Beta 53 head-mounted condenser microphone.
- Terason t3000 ultrasound machine with ultraspeech software (Hueber et al., 2008).
- Articulate instrument headset for probe stabilization (Scobbie et al., 2008).
- Video camera (DFM 22BUC03-ML) for lip movements.
- Phone-level transcription was achieved using P2FA (Yuan & Liberman, 2008).
- Segmentation was manually corrected as necessary (Pennington, 2018).
- Ultrasound frames closest to 10ms before the end of each stop closure were selected.
- Tongue contours were analysed with SSANOVA.





- Acoustic: 3-way laryngeal contrast is well-differentiated.
- As one might expect, there are differences in tongue height in palatals and tongue tip height in retroflexes (both speakers).
- Interestingly, tongue root is slightly advanced for voiced stops (both speakers).
- Higher tongue tip for retroflexes (apical) than other two coronals (both speakers).

Results



Discussion & Remaining Issues

- Articulation of retroflexes (apical or sub-apical) across Tibeto-Burman, Indo-Iranian, and Dravidian languages.
- Differences in sub-families: Lolo-Burmese, Karenic and other Tibeto-Burman languages.

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